

Land Use Change & Forestry (Biodegradable Carbon Emissions & Sinks)

Emissions (MMTCO2)																
Category	Data Source	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sinks																
Forest Land (Sinks)		-14.245	-14.221	-14.197	-14.172	-14.148	-14.148	-14.148	-14.148	-14.148	-14.148	-14.148	-14.137	-14.127	-14.116	-14.105
Forest Growth	Winrock	-13.141	-13.118	-13.096	-13.074	-13.052	-13.052	-13.052	-13.052	-13.052	-13.052	-13.052	-13.042	-13.032	-13.022	-13.012
Rangeland Growth	Winrock	-1.104	-1.102	-1.100	-1.099	-1.097	-1.097	-1.097	-1.097	-1.097	-1.097	-1.097	-1.096	-1.095	-1.094	-1.093
Total Sinks		-14.245	-14.221	-14.197	-14.172	-14.148	-14.148	-14.148	-14.148	-14.148	-14.148	-14.148	-14.137	-14.127	-14.116	-14.105
Emissions																
Forest Land (Emissions)		3.261	3.255	3.250	3.244	3.239	3.239	3.239	3.239	3.239	3.239	3.239	3.236	3.234	3.231	3.229
Forest/Rangeland Fires (Combustion & Decomposition)	Winrock	2.032	2.028	2.025	2.022	2.018	2.018	2.018	2.018	2.018	2.018	2.018	2.017	2.015	2.014	2.012
Development of Forest/Rangelands (Land Use Change)	Winrock	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
Forest/Rangeland Other Emissions (Unspecified)	Winrock	1.208	1.206	1.204	1.202	1.200	1.200	1.200	1.200	1.200	1.200	1.200	1.199	1.198	1.197	1.196
Slash Left Behind from Harvests (Decomposition)	Winrock	0.156	0.156	0.156	0.156	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155	0.155
Fuel Wood from Harvests (Combustion)	Winrock	1.532	1.529	1.526	1.524	1.521	1.521	1.521	1.521	1.521	1.521	1.521	1.520	1.519	1.518	1.517
Composting of Wood Waste Materials (Decomposition)	CIWMB/USEPA	0.255	0.305	0.354	0.403	0.451	0.500	0.549	0.597	0.646	0.694	0.743	0.743	0.745	0.800	0.803
Wood Waste Dumps	CIWMB	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Landfilled Wood Waste (Emissions)	ARB Model	2.350	2.438	2.577	2.815	2.988	3.170	3.268	3.261	3.392	3.357	3.469	3.655	3.779	3.746	3.740
Total Emissions		7.555	7.683	7.863	8.142	8.355	8.586	8.733	8.774	8.953	8.967	9.127	9.310	9.432	9.450	9.444
Net CO2 Flux		-6.690	-6.537	-6.333	-6.030	-5.793	-5.563	-5.415	-5.374	-5.195	-5.181	-5.021	-4.827	-4.695	-4.666	-4.662

Description
<p>The net CO₂ flux for the forest sector is estimated from summing CO₂ removals from the atmosphere and CO₂ emissions to the atmosphere on managed lands and the wood products pool. Removals of CO₂ from the atmosphere occur as a result of vegetation growth. Emissions of CO₂ to the atmosphere occur as a result of a variety of land use activities. These include emissions from oxidation of timber harvest slash, fuel wood, biomass consumed in wildfires, other disturbance (land use change or unspecified), or from the decomposition of landfilled or composted wood products consumed in the state. CO₂ removals and emissions by urban forests will be included pending further data. This table focuses on forested lands, therefore CO₂ removals and emissions on (non)woody crop lands are not reported, pending further study.</p>

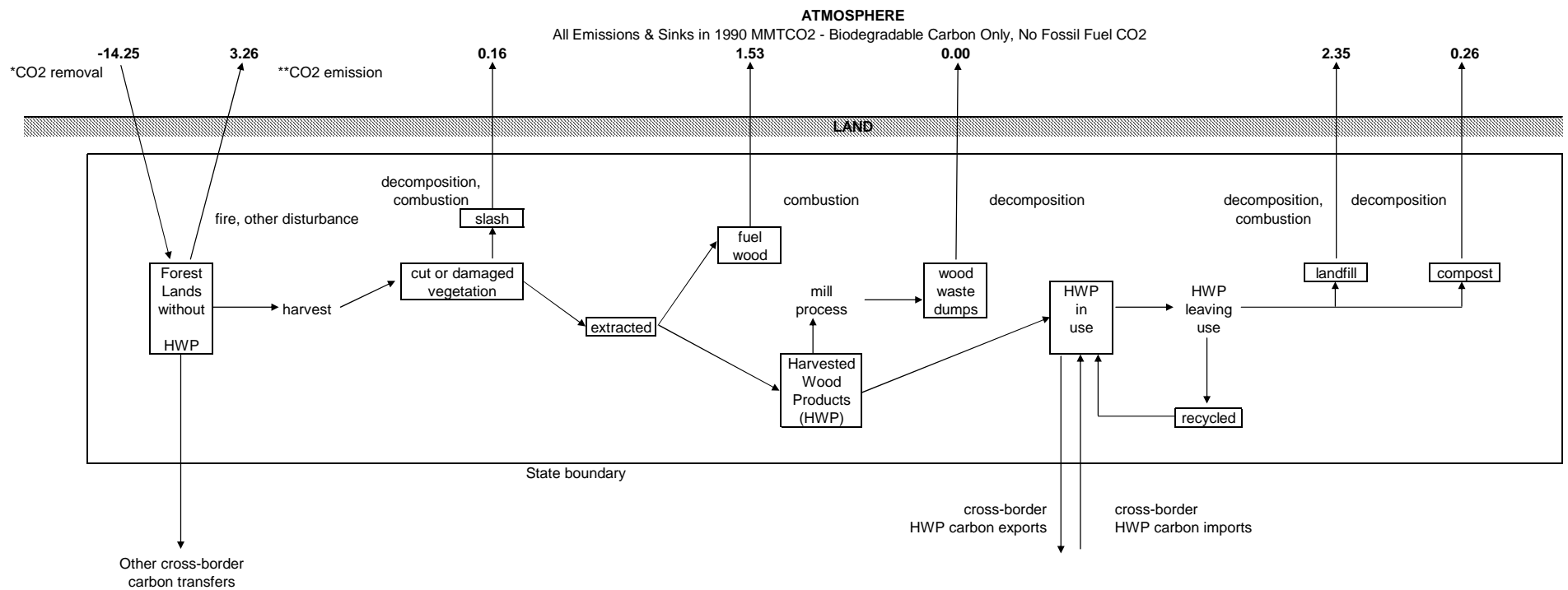
Data Sources
<p>Winrock: CEC (2004). Baseline Greenhouse Gas Emissions for Forest, Range, and Agricultural Lands in California. CEC PIER final report CEC-500-04-069F. Annual average forest and range land CO₂ removal and emission rates for period 1994 - 2000 in Table 1-21, CEC (2004) scaled to state-wide in CEC (2006): Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004. Publication CEC-600-2006-013-SF. Emissions and removals are back-cast to 1990 from 1994 using 0.1707% per year forest land area trend from 1953 to 1994, from p. 14 in Shih (1998): The Land Base of California's Forests. Fire and Resource Assessment Program, California Dept. of Forestry and Fire Protection. Emissions and removals forecasted from 2000 using 4% forest land area decline predicted for 1997 to 2050 in the Pacific Coast Region, from p. 53 in: Area Changes for Forest Cover Types in the United States, 1952 to 1997, with projections to 2050. (2004) USDA Forest Service, Pacific Northwest Research Station, publication PNW-GTR-613.</p> <p>CIWMB/USEPA: California Integrated Waste Management Board SWIS waste-in-place and landfill survey data, USEPA Harvested Wood Products use data provided by Kenneth Skog (Forest Products Laboratory, USDA Forest Service, Madison, WI), scaled to state based on population.</p> <p>ARB Model: From IPCC Mathematically Exact First-Order Decay Model, with CIWMB SWIS waste-in-place and landfill survey data.</p>

Diagram of the Atmospheric Flow Approach to forest and wood products carbon accounting for the forest sector of the state GHG inventory.

Adapted from:

- Figure 12.A.2. System boundary of the Atmospheric Flow Approach.
In: Chapter 12, Harvested Wood Products. Volume 4, Agriculture, Forestry, and Other Land Use (AFOLU). 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
IPCC National Greenhouse Gas Inventories Programme.
- Figure 1-6. Flow diagram illustrating the various destinations of pre-harvest carbon after commercial harvest.
In: Baseline Greenhouse Gas Emissions for Forest, Range, and Agricultural Lands in California. (2004) California Energy Commission PIER final report 500-04-069F.

$$1990 \text{ Net CO}_2 \text{ Flux (MMTCO}_2\text{)} = \text{Emissions} + \text{Sinks: } 7.55 + (-14.25) = \boxed{-6.69}$$



*CO₂ removal from the atmosphere includes vegetation growth in Forests and wooded Range Land.

**Land Use Change & Forestry CO₂ emissions to the atmosphere includes emissions from: Forest and Range land fires, Forest and Range land use change (development) and other unspecified disturbance, decomposition/combustion of slash from tree harvest, fuel wood combustion, decomposition of wood mill waste and Harvested Wood Products in landfills and composting facilities.

The Atmospheric Flow Approach estimates fluxes of carbon to and from the atmosphere for the forest and wood products pools within the state boundary, and reports where and when emissions to the atmosphere and removals from the atmosphere occur. The state includes in its estimate of emissions/removals the removals of carbon from the atmosphere due to vegetation biomass growth, and the carbon release to the atmosphere from the oxidation of harvested wood products that are consumed in the state. (Adapted from: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry, and Other Land Use.)